

Wake County
Structural Stormwater Best Management Practices
(BMPs)
3rd Annual Inspections Report
05.05.11



Regulatory Background

Stormwater management devices mandated by Wake County stormwater regulations began with the implementation of the State's Neuse River Nutrient Management Strategy or "Neuse Rules" in July 2001. Related regulations were incorporated in the *Wake County Stormwater Control Management and Watercourse Buffer Regulations* adopted on July 2, 2001. This ordinance required stormwater management if a development proposed an impervious surface coverage (ISC) of greater than 15%. Developments with proposed impervious surfaces in excess of 15% were required to install stormwater management devices to handle the stormwater runoff. Most residential subdivisions met the stormwater requirements by stating the development would not exceed the 15% impervious surface limit. Impervious surface coverage (ISC) limits were established and recorded for individual lots to ensure that the cumulative ISC for a new development would not exceed 15% upon build-out.

The *Wake County Stormwater Control Management and Watercourse Buffer Regulations* were repealed and replaced with Article 9 Stormwater Management of the Unified Development Ordinance (UDO) in May 2006. This existing ordinance requires residential development to meet post development runoff volumes established by target curve numbers. The Neuse Rules continue to apply to both residential and non-residential development and regulate peak flow management and nitrogen reduction.



Commercial Dry Detention Pond

BMPs Generated by Individual Lot Impervious Surface Limit Deviations

The *Wake County Stormwater Control Management and Watercourse Buffer Regulations* (2001) allowed developers to passively be exempted from ordinance requirements by committing to limit the total impervious surface coverage (ISC) of the development to 15%. This required the establishment of maximum ISC limits for individual subdivision lots, so that the aggregate ISC for the subdivision as a whole did not exceed 15%. By agreeing to record impervious surface coverage (ISC) limits on the record plat for individual lots, the development was exempted from the stormwater management requirements and was allowed to record the subdivision plat and sell the newly created lots.

After recording the subdivision plats with impervious surface limits (ISC) limits and trying to sell lots to builders and individuals, it soon became apparent that the 15% ISC limit was insufficient in some cases to meet market demand. Developers, builders and lots owners then sought quick fixes to the ISC limits through a variety of methods: 1) deviations that required installation of BMPs on individual lots to manage excess runoff; 2) rerecording lots to reassign ISC (taking a portion of ISC allotment assigned to unsold lots and adding it to other lots; and 3) retrofitting subdivisions with regional devices.

The County established a de facto policy of allowing individual lot deviations by approving impervious surface amounts above the recorded limit if stormwater runoff from the excess impervious surface was managed on-site. Best management practices such as installing infiltration trenches, grass swales, bioretention, rain barrels, dry detention and cisterns are some of the devices used to control the runoff volume above the amount generated by the impervious surface limit. Lots in subdivisions approved from July 2001 until July 2005 are allowed to deviate.



Single Family Bioretention (Dry)



Single Family Bioretention (Wet)

The deviation policy initiated Wake County's allowance of BMPs on individual lots to satisfy stormwater ordinance requirements. Other jurisdictions, including the cities of Raleigh and Cary, allow only regional devices. Beginning in July 2005, the County required subdividers to add a note on the final subdivision plat, which prohibited deviations from the impervious surface limit in perpetuity. The County's deviation policy is one of two main policies generating BMPs; the other is current stormwater ordinance. In recent years developers have established higher ISC limits allowing them to meet demand, the result being more BMP's both structural and non-structural.



Rain Barrel

New State Legislation Likely to Increase Number of BMPs

Wake County will be required to implement the new development rules in the Jordan and Falls Lake Watersheds in 2012 as required by the State legislation creating the Falls Lake Nutrient Management Strategy (NMS) and the Jordan Lake Nutrient Management Strategy. These rules establish target export rates for nitrogen and phosphorus for new development.

The rules are in addition to Wake County's stormwater regulations and are likely to result in more BMPs. Wake County's Ordinance is based on volume control which can be achieved through site design or the use of BMPs. Implementation of the new development rules for the Jordan Lake and Falls Lake Nutrient Management Strategy in

2012 will establish different target export rates for total nitrogen and establish target export rates for total phosphorus for the first time in Wake County. The nutrient targets of the Falls Lake and Jordan rules are likely to require BMPS with higher nutrient removal efficiencies than might otherwise be required by the County's ordinance. We expect these regulations in addition to future turbidity standards to increase the number of BMPS and the percentage of projects required to install BMPs

Stormwater Wetlands

According to the NC Division of Water Quality Stormwater Best Management Practices Manual, constructed wetlands are a good choice for nutrient and sediment removal with: 1) 85% Total Suspended Solid removal efficiency; 2) 40% total nitrogen removal efficiency and; 3) 40% total Phosphorus removal efficiency.



Constructed Wetland

BMPs Generated by Volume Control Regulations Adopted in 2006

In 2006, *Article 9 Stormwater Management of the Unified Development Ordinance* replaced the stand alone *Stormwater Control Management and Watercourse Buffer Ordinance* with new stormwater regulations. The new regulations established stormwater volume controls for residential developments, in addition to the Neuse River Nutrient Management Strategy stormwater regulations. Residential stormwater runoff volume is now required to meet a target volume (curve number). Developers can meet the target curve number by employing a variety of non-structural best management practices such as disconnecting impervious surface, preservation of wooded areas, and reforestation.

If the proposed development cannot meet the target curve number with site practices alone, then structural best management practices are employed to meet the volume control requirements. Examples of structural best management practices included wet and dry detention basins, constructed wetlands, underground detention devices, infiltration devices, bioretention, etc. The current ordinance allows both regional and individual lot BMPs, which must be maintained by an owners' association. Dry and wet detention ponds (shown below) are types of BMPs frequently used to achieve the volume storage required by the UDO.



Wet Pond



Dry Detention Pond

Table 1 presents the Best Management Practices (BMPs) regulated by Wake County:

Table 1 Wake County Regulated Best Management Practices		
BMP Type	Regulatory Source	Required
Individual lot deviations	Wake County Stormwater Control Management and Watercourse Buffer Regulations	If owner of lots created between 07.02.01 and 05.19.06 want to exceed recorded impervious surface limits for lots
Regional Residential BMPs	Wake County Stormwater Control Management and Watercourse Buffer Regulations & Article 9 UDO	Under the Wake County Stormwater Control Management and Watercourse Buffer Regulations when proposed ISC exceeds 15% and under Article 9 when proposed development cannot meet target curve number without devices
Commercial BMPs	Wake County Stormwater Control Management and Watercourse Buffer Regulations & Article 9 UDO	For peak flow management and nitrogen reduction requirements of the Neuse Rules
Level spreaders	Neuse Rules	401/404 permits and/or to ensure diffuse flow into buffers
Regional Residential Retrofits	Wake County Stormwater Control Management and Watercourse Buffer Regulations & Article 9 UDO	Responsible party cannot or does not want to abide by terms of development approval which created subdivision; seeks a retrofit to allow greater ISC

NPDES Phase II Permit

In 2003, Wake County operating under the assumption that it would be subject to an NPDES Phase II General Permit and submitted a draft permit application and Stormwater Management Plan. In 2010, the State sent a revised draft permit for Wake County's

review. Upon review of the 2010 draft permit language, it became apparent that the General Permit was not applicable to Wake County as it does not operate a Municipal Separate Storm Sewer System (MS4). Upon certification in July 2010 that the County does not own or operate a Municipal Separate Storm Sewer System, the County was no longer required to obtain a General Stormwater Discharge Permit.

Nonetheless, the adoption of the new stormwater regulations in 2006 coincided with the implementation of post-construction stormwater management requirements under the National Pollution Discharge Elimination System (NPDES) Phase II rules adopted by the State. Phase II post-construction requirements include the identification of parties responsible for the long-term maintenance and operation of BMPs, development of a long-term maintenance plan including financing of operations and maintenance.

Article 9 Stormwater Management of the UDO, Section 9-32 Assurance That Improvements Will Be Maintained - requires the developer to maintain the improvements until accepted by a property owner or property owners association. The developer must disclose which party will be responsible for continued maintenance on the record plat and on the required stormwater management plan. Prior to this acceptance, the developer must provide certification to the property owner and property owners association and to the County that improvements are complete and functioning as designed. The developer must then record a maintenance plan that instructs the property owners association or lot owner about the annual maintenance tasks and associated cost for at least a 20-year period.

Wake County's Obligation to Inspect BMPs

The Unified Development Ordinance assigns responsibility for annual BMP inspections and reporting to the property owner or an owners association. In an effort to monitor the effectiveness of private sector maintenance and inspections, Wake County began its own annual inspections of private BMPs in 2009, although it is under no statutory obligation to do so. Wake County elected in 1992 to follow the low density option to comply with the State's Water Supply Watershed regulations. Under the low density option, Wake County is not required to maintain BMPs. However, if it had elected the high density option, the County would be responsible for such maintenance.

The economic recession that began in 2007 had by 2009 resulted in a decline in the number of active development projects; which allowed the reallocation of staff resources to initiate annual inspection of BMPs in 2009 and continue in 2010 and 2011. In addition to maintenance inspections, Wake County needs to inspect devices, particularly those that will be located underground, during installation to ensure proper installation and functionality. The County should also inspect BMPs upon the submittal of an as-built to verify accuracy and compliance. Additionally, periodic inspections should be



conducted to monitor the effectiveness of the private inspections and of the self-reporting system.

The initial list of permitted BMPs included known BMPs from a database created in 2006 and individual lot deviation files. A new BMP Excel database was established in October 2008 to support the tracking of all BMPs, inspections and status. This database is now being used by all Stormwater staff. Efforts to identify all existing BMP's dating back to 2001 (implementation of the Neuse Rules) will focus on three areas: 1) mainframe search of all projects; 2) review of hardcopy files to determine which ones have BMPs and 3) Identification of level spreaders. Note: Level spreaders are required by the State under the Neuse Rules for diffuse flow. In the past, level spreaders were not consistently recognized as permanent stormwater control devices. It is now the policy of Wake County to treat all level spreaders as permanent stormwater devices subject to maintenance requirements.



Level Spreader (well-maintained)



Level Spreader (maintenance needed)

Watershed Management Section Inspection Certification

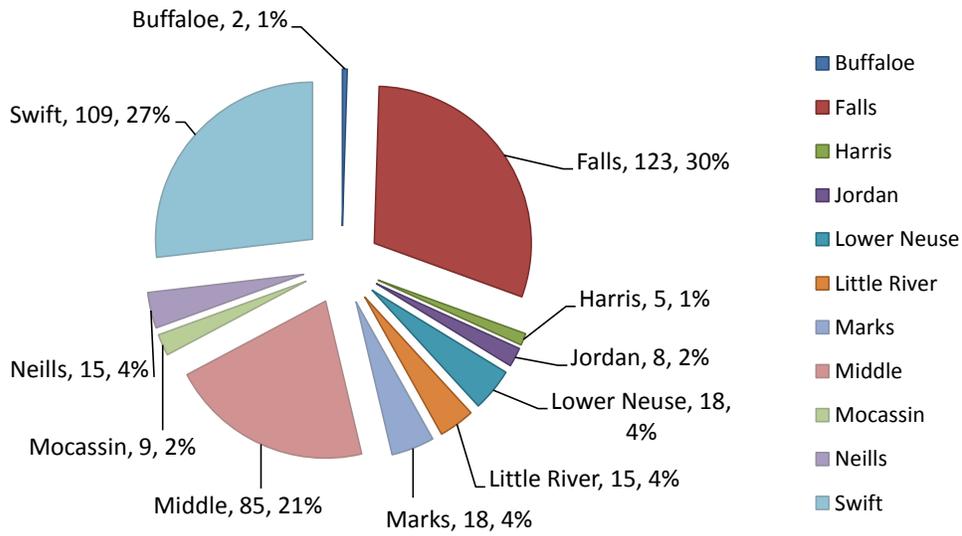
In October 2008, all eight members of the Watershed Section completed the Stormwater BMP inspection & Maintenance Certification Course offered by the NCSU, Department of Biological and Agricultural Engineering Program. The UDO requires the party responsible for maintenance of the BMP to provide annual inspections reports by a certified professional. County staff is not required to be certified, but they continue to pursue professional development on an on-going basis as it relates to stormwater plan review, approval, inspections and maintenance.

Table 2 below information summarizes annual inspections performed by Wake County staff from the 4th quarter 2010 through April 2011.

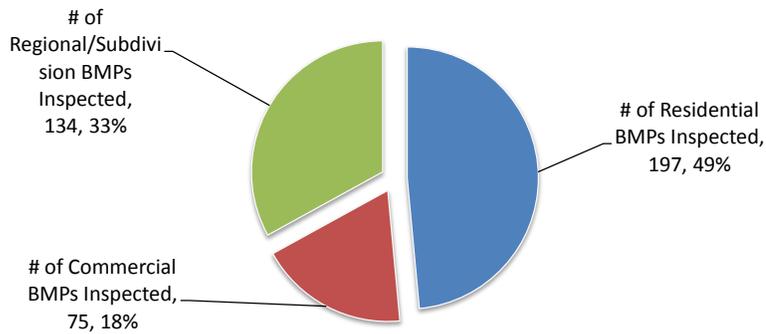
Table 2
Summary of 2011 BMP Inspections

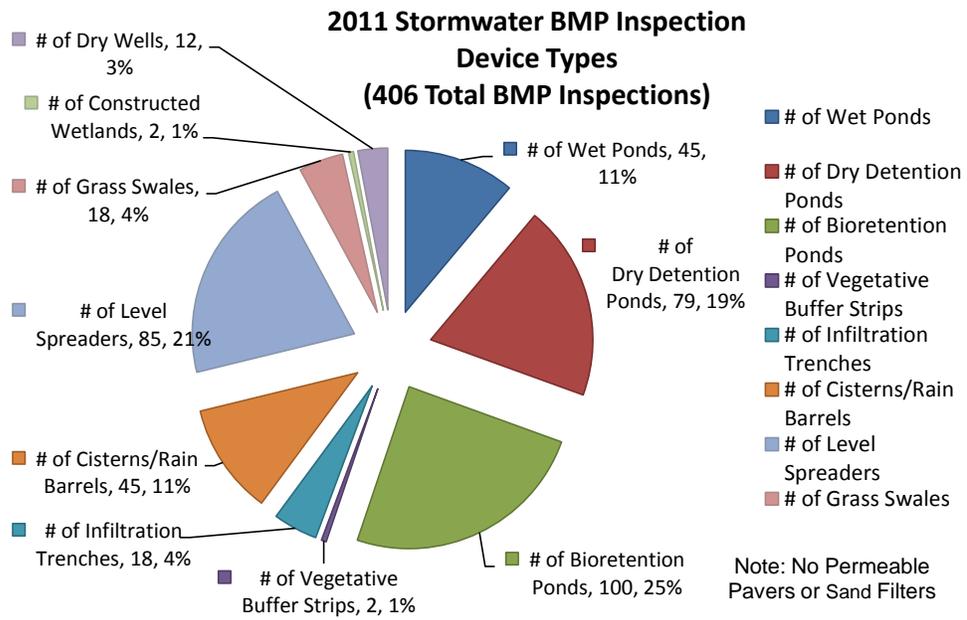
Total No. of Projects	232
Total No. of BMPs	406
No. of Residential BMPs Inspected	197
No. of Commercial BMPs Inspected	75
No. of Regional/Subdivision BMPs Inspected	134
No. of Devices Present	304
No. of Devices Not Present, 2 devices unknown	100
No. of Devices Not constructed or converted due to S&E	61
No. of Devices in Compliance	227
No. of Devices in Need of Corrective Action	123

**2011 Stormwater BMP Inspections
of BMPs per Watershed**

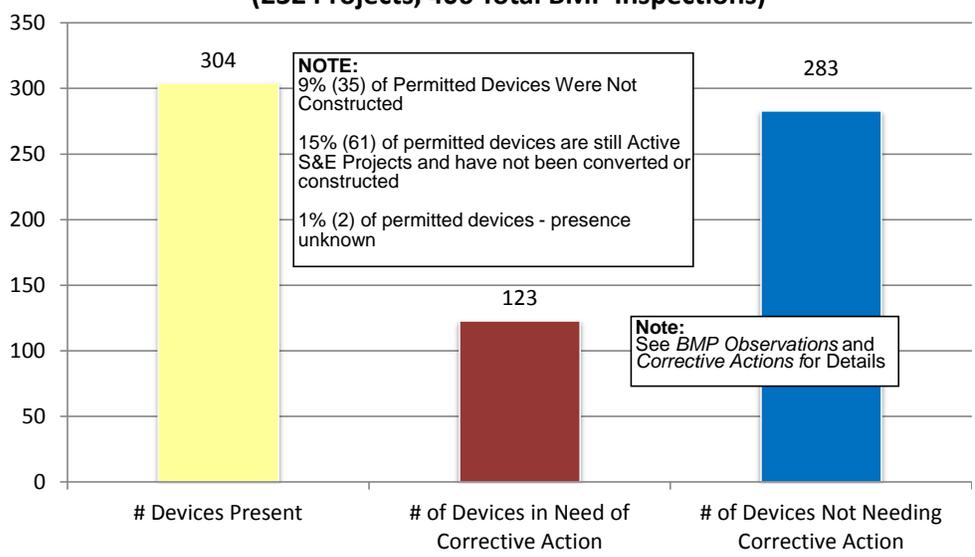


**2011 Stormwater BMP Inspections
Classifications by Residential, Commercial, and Subdivision
(406 Total BMP Inspections)**

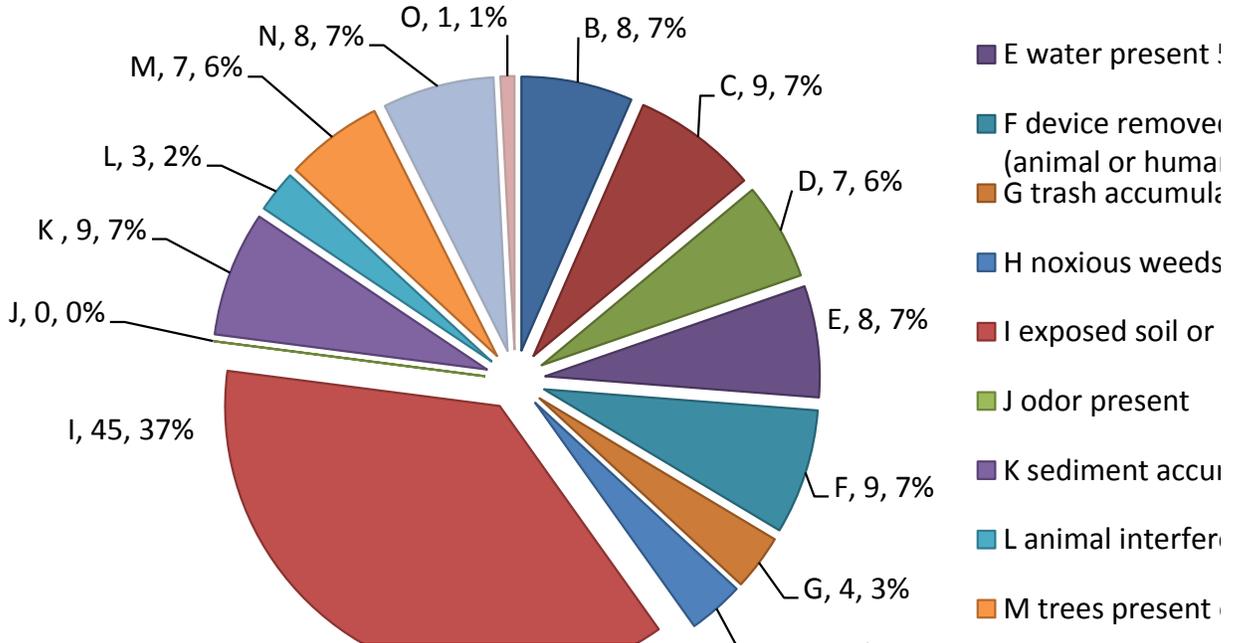




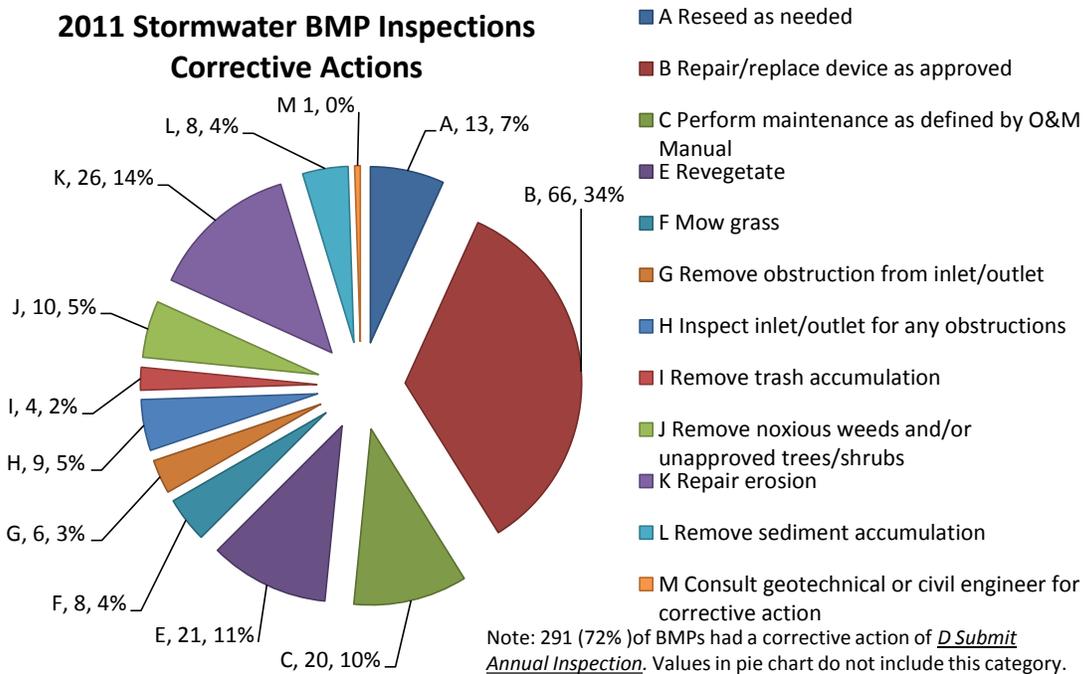
Overall 2011 Stormwater BMP Inspection Results (232 Projects, 406 Total BMP Inspections)



2011 Stormwater BMP Inspection Observations



2011 Stormwater BMP Inspections Corrective Actions



Report Enhancements New in 2011

In 2010, as part of the Stormwater management mainframe enhancement project, new fields were added to the mainframe building permit screens to standardize and capture basic BMP data. The advantage is that for the first time BMP data is searchable by the interdepartmental development services staff. However, given the limitation of space on the existing mainframe permit screens, we continue to use an excel spreadsheet to document



additional BMP data and to generate ad hoc reports. Our current records are significantly more accurate and detailed than those from 2006 and are more inclusive of level spreaders than in 2009 or 2010. Watershed Management staff has reviewed the closed out files scheduled for disposal in 2010 (older than 6 years) to identify previously untracked level spreaders. These will be added to the bmp inventory. In 2011 staff will review all remaining closeout files to identify all other untracked level spreaders.

The on-going mainframe enhancement project with Information Services will result in the conversion this year of our Excel BMP database to the mainframe. Persons with mainframe access will be able to check on the status of BMPs throughout the approval, permitting, close out and life cycle maintenance. This will include a built inspections, annual staff inspections, owner inspections, complaints, enforcement action, and follow-up actions.

Municipal BMPs Tracked By Wake County

Pursuant to interlocal agreements executed in 2010, Wake County administers the new municipal stormwater ordinance for the Towns of Wendell, Rolesville and Zebulon and will maintain the same level of information on the municipal BMPs as those in the County. This information will be searchable on the mainframe and the County will generate custom reports for each municipality.

New GIS Based BMP Inventory Map

Using GIS, staff has developed a BMP inventory map that includes georeferences. Next year, we anticipate using the handheld Trimbles to enter annual inspection data and photos in the field which will automatically be uploaded into the existing BMP inventory attribute table, greatly reducing staff time devoted to data entry. Digital documents can

now be hotlink to data points on the BMP map. This will allow easy access to such documents as photos and as-built site plans. The utility of this GIS based system is limited by the fact that the Watershed Management Section has only 3 licenses. These licenses originally resided with the stormwater staff as ARCGIS has functional utility advantages over MAPS for stormwater plan review. Ideally, each staff member would have ARCGIS and a laptop capable of running it in the field. Currently, none of our laptops are capable of running the County's current version of GIS. The ARCGIS licenses are assigned as follows: Betsy Pearce, Shawn Springer and the shared PC.

Summary

Two hundred thirty-two (232) projects and four hundred (406) BMPs were inspected for this report. Three hundred and four (304) BMPs were present. Those not present included still active sedimentation or erosion control projects (61) or were never installed, not visible, or had been removed (37). One hundred twenty-three (123) required corrective action and 238 required no corrective action. Forty-eight percent (48%) of the projects inspected were individual lot deviation sites. The findings below identify problems that need to be addressed and the recommended corrective action to be taken.

Findings and Recommendations

1. Finding: The allowance of deviations was never codified and related policies and procedures were developed and modified ad hoc by staff.

Issue: Lack of consistency in policy has resulted in inconsistent administration and implementation of the deviation program.

Recommendation: Enhance deviation policies and standard operating procedures and publish on web page.

2. Finding: Deviations on single family lots account for 49% of all BMPs.

Issue: Inadequate maintenance, owners' lack of understanding regarding functional necessity of BMP, maintenance requirements and lack of adherence to annual reporting requirements are common.

Recommendation: Develop educational campaign targeting owners of individual lot BMPs regarding maintenance obligations/practices.

3. Finding: Devices deteriorate over time when not properly maintained.

Issue: Owners' defer maintenance.

Recommendation: Recommend follow-up inspection within to ensure remediation and implement targeted educational campaign.

4. Finding: Device does not function as intended.

Issue: Poor design, less than optimal choice of device, failure to construct according to plan, failure to capture runoff, lack of maintenance, etc.

Recommendation 1: Develop standard specifications for most commonly used devices and provide guidelines on selection and location of device.

Recommendation 2: Consider requiring plan prepared by a design professional for individual lot deviations.

Recommendation 3: Develop an inspection schedule for installation and post construction of all measures.

Recommendation 4: Require corrective action by responsible party.

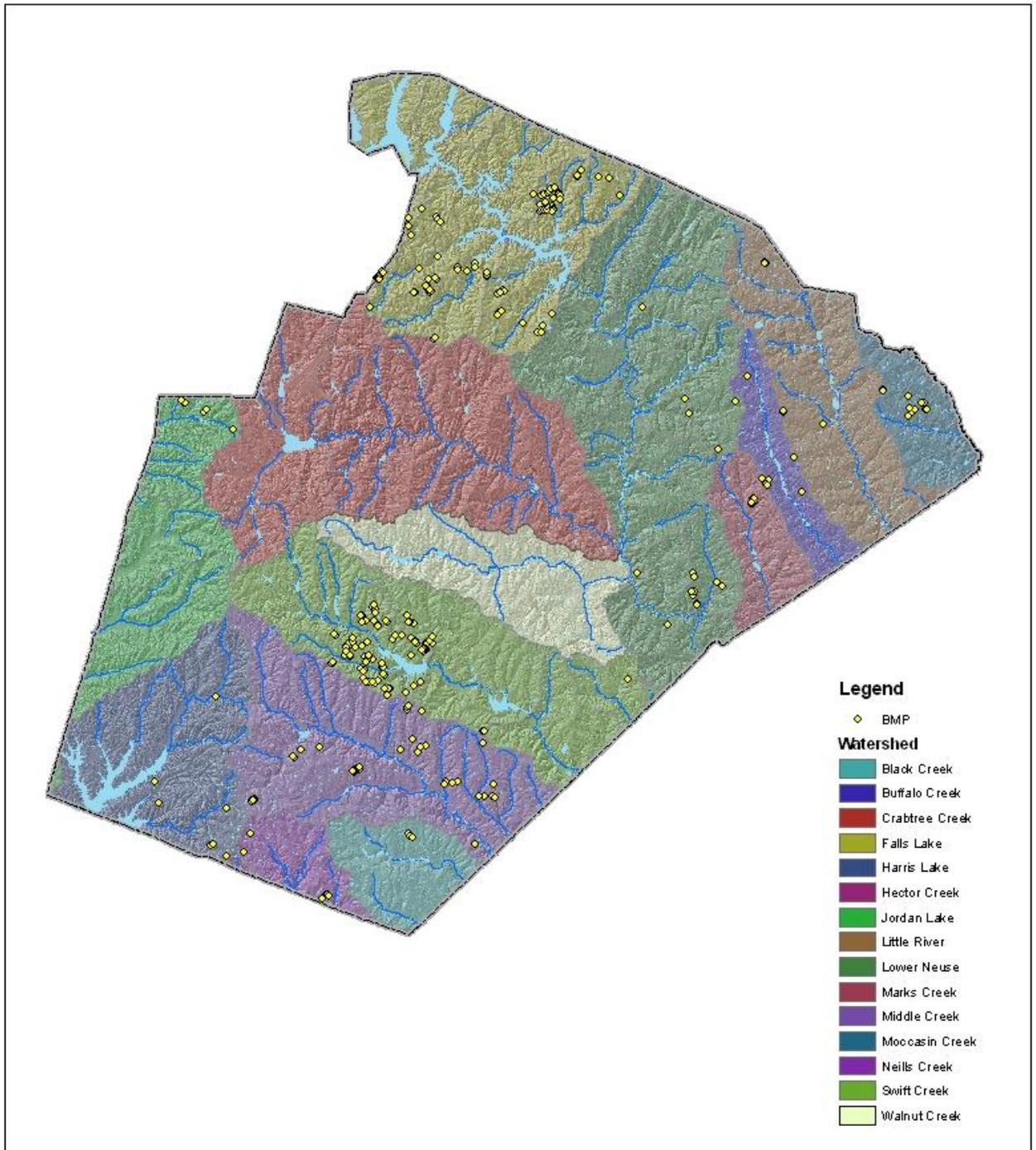
5. Finding: Coordination needed for conversion of E&SC devices into permanent stormwater devices.

Issue: Conversions may not follow standard E&SC methods/procedures such as proper dewatering, discharge, and stabilization.

Recommendation: Discuss conversion issue at the pre-construction conference; require onsite discussion of methods/procedures to be used in conversion prior to initiation.

Follow-up Action

- Continue to update the BMP database to include new projects, projects with level spreaders and legacy files
- Annual inspections of all documented BMPs
- Annual written communication with all responsible parties
- Compliance and/or enforcement
- Responsible party education and training
- Complete data management project w/IS, train staff on new mainframe functions/reporting
- Enhancement of policies and procedures
- Quarterly reporting



1 inch = 30,000 feet

**Map of Wake County showing:
BMP's by Watershed**

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